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Mindfulness Meditation Increases the Accuracy of Source Attributions

Abstract

Mindfulness is a component of several psychotherapeutic programs. There is research supporting the effectiveness of some of these programs. Theories and definitions of mindfulness have been proposed. To clarify what mindfulness is and how it works, there is a need for research demonstrating the specific effects of mindfulness practice. In the present study, a group of participants who practice mindfulness meditation and a group of non-meditators were shown a video depicting a car crash followed by an assault and theft. Immediately after viewing the video, participants answered questions about perceptual details of the video. About half of the meditators and about half of the non-meditators answered misleading questions. After completing the first questionnaire participants answered another set of questions to assess whether they had been misled. It was hypothesized that meditators would notice more details, remember more of their subjective experience of watching the video, and therefore give more accurate responses and fewer misled responses. Although the two groups did not differ significantly in their overall accuracy, meditators gave significantly fewer misled responses than non-meditators did. It is proposed that mindfulness meditation increases the accuracy of source monitoring by increasing practitioners' awareness of subjective experience.

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Dissertation

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MINDFULNESS MEDITATION INCREASES THE ACCURACY OF SOURCE

ATTRIBUTIONS

A DISSERTATION

SUBMITTED TO THE FACULTY

OF

SCHOOL OF PROFESSIONAL PSYCHOLOGY

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BY

ADAM BROTMAN

IN PARTIAL FULFILLMENT OF THE

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ABSTRACT

Mindfulness is a component of several psychotherapeutic programs. There is research supporting the effectiveness of some of these programs. Theories and definitions of mindfulness have been proposed. To clarify what mindfulness is and how it works, there is a need for research demonstrating the specific effects of mindfulness practice. In the present study, a group of participants who practice mindfulness meditation and a group of non-meditators were shown a video depicting a car crash followed by an assault and theft. Immediately after viewing the video, participants answered questions about perceptual details of the video. About half of the meditators and about half of the non-meditators answered misleading questions. After completing the first questionnaire participants answered another set of questions to assess whether they had been misled. It was hypothesized that meditators would notice more details, remember more of their subjective experience of watching the video, and therefore give more accurate responses and fewer misled responses. Although the two groups did not differ significantly in their overall accuracy, meditators gave significantly fewer misled responses than non-meditators did. It is proposed that mindfulness meditation increases the accuracy of source monitoring by increasing practitioners' awareness of subjective experience.

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INTRODUCTION

Interest in mindfulness among the general public and among mental health clinicians has increased during the last decade or more, as evidenced by the number of books and articles written on the subject and by the development and increasing popularity of treatment programs in which mindfulness is a component. Much has been written about the benefits of mindfulness practice, which are thought to include increased emotional stability and greater ability to tolerate psychological discomfort.

The vast literature on mindfulness includes treatment protocols in which the authors describe and provide a rationale for the use of mindfulness in reducing specific forms of psychological distress. Some research has shown that these programs are more effective than other forms of treatment. Other research, mostly several decades old, has investigated effects of meditation, though mostly not mindfulness meditation. There is little research investigating the specific effects of mindfulness practice. The present study is intended to contribute to our scientific knowledge of mindfulness.

One way to research the effects of mindfulness practice is by comparing practitioners to non-practitioners in their performance on a task requiring skills mindfulness practice is thought to develop. Researchers and proponents of mindfulness have described mindfulness as a way of paying attention that includes observing the continuous flow of one's thoughts, feelings and perceptions (Kabat-Zinn, 1994; Gunaratana, 2002). Source attribution is a cognitive task individuals perform more accurately when they are aware of their cognitive processes while witnessing and

recalling events (Johnson, Hashtroudi, & Lindsay, 1993). Also, when individuals can recall various aspects of an event they witnessed, such as thoughts, feelings and sensations they experienced during the event, they can more accurately distinguish memories of the event from memories of what they later read or were told about the event (Zaragoza & Lane, 1994). Because mindfulness involves awareness of present moment experience, I hypothesized that individuals who observe an event mindfully would make more accurate source attributions.

Some research suggests that individuals, by practicing mindfulness, increase their likelihood of paying attention mindfully throughout their day. Brown and Ryan (2003) found individuals naturally vary in their degree of trait mindfulness, as measured using the Mindful Attention and Awareness Scale (MAAS). The MAAS contains questions about one's tendency to pay attention to or show awareness of ordinary experiences as they are occurring. Brown and Ryan (2003) also found that individuals increase their trait mindfulness through practice. Given that mindfulness practice increases trait mindfulness, I hypothesized that mindfulness practice would increase the accuracy of source attributions.

The purpose of the present study was to gain understanding of the cognitive effects of mindfulness practice. In the study I investigated a way in which individuals practicing mindfulness meditation improve their memory and attention. Specifically, practitioners of mindfulness meditation were compared with non-meditators on their memory for details of a witnessed event, and on a source attribution task, which involved recognizing discrepancies between a witnessed event and information contained in questions about the event. It was hypothesized that the meditators, because of their

increased awareness of thoughts, feelings and sensations as they are occurring, would show more accurate recall of an event and would show less susceptibility to misleading post-event information.

In this study, 24 meditators and 25 non-meditators were shown a clip from a movie depicting a crime scene. After they watched the video they responded to questionnaire items about details of the video. Twenty-two of the participants received questionnaires that contained misleading information embedded in the questions; the rest received a non-misleading questionnaire. After participants completed and turned in the first questionnaire they were given a second questionnaire. The second questionnaire contained 5 questions testing participants' accuracy of recall on information about which some had received misleading information. If participants at this stage gave the misleading information as their response, I considered their response the result of a source attribution error, meaning that the misled participants failed to discern whether the information they remember came from the video or the questionnaire. I compared the meditators to the non-meditators in their number of accurate responses and their number of misled responses. I hypothesized that meditators would show greater accuracy overall and would give fewer misled responses, showing greater accuracy in their source attributions.

To provide a context for this study, I will first discuss definitions and descriptions of mindfulness, focusing on how mindfulness practice is thought to affect attention and awareness of experience. I will discuss the utility of researching cognitive effects of mindfulness practice in understanding the benefits practitioners derive. I will then review the literature on mindfulness research and on the related area of meditation, with an

emphasis on findings related to attention. Moving into a discussion of source attributions, I will review the literature on cognitive processes considered necessary for making accurate source attributions, including attentional processes and the role of awareness. Through this discussion I will propose a relationship between source attributions and mindfulness and I will present my hypothesis that practitioners of mindfulness meditation will make more accurate source attributions than non-practitioners will. I will then describe the present study.

Definitions and Theories of Mindfulness

In beginning a discussion of how mindfulness is described and defined it is useful to address whether “mindfulness” refers to a skill, a practice or a trait. In the definitions I will discuss, the distinction is not explicitly addressed. As I will discuss in more detail later in this paper, research shows some lasting and relatively stable changes in attention (Brown & Ryan, 2003) and brain activity (Davidson et al., 2003) resulting from “mindfulness practice,” suggesting mindfulness could be a trait. Individuals might pay attention mindfully more often the more they practice, and individuals who do not practice vary in their degree of mindfulness (Brown & Ryan, 2003), giving mindfulness the quality of a trait. For the purpose of this paper, I will use the term “mindfulness” to mean a way of paying attention, which can reasonably be viewed as a skill or potentially a trait. I will use the phrase “mindfulness practice” to mean exercises or activities widely thought to increase individuals’ ability and tendency to pay attention mindfully.

Various definitions of mindfulness have been developed, many of which refer explicitly to attention and awareness of experience. Kabat-Zinn (1994) defined mindfulness as paying attention “on purpose, in the present moment, and

nonjudgmentally,” (p. 4) and many researchers have quoted this definition (e.g., Baer, 2003; Brown & Ryan, 2003; Roemer & Orsillo, 2002; Segal, Williams, & Teasdale, 2002.) Nyanaponika (1972) defined mindfulness as “the clear and single-minded awareness of what actually happens to us and in us at the successive moments of perception” (p. 5). Hanh (1976) defined it as “keeping one’s consciousness alive to the present reality” (p. 11). Gunaratana (2002) wrote about the difficulty of using words to describe the “presymbolic” (p. 137) experience of mindfulness. He characterized it as follows:

“When you first become aware of something, there is a fleeting instant of pure awareness just before you conceptualize the thing, before you identify it. That is a state of awareness...In the process of ordinary perception, the mindfulness step is so fleeting as to be unobservable. We have developed the habit of squandering our attention on all the remaining steps, focusing on the perception, cognizing the perception, labeling it, and most of all, getting involved in a long string of symbolic thought about it...It is the purpose of vipassana [mindfulness] meditation to train us to prolong that moment of awareness.”
(Gunaratana, 2002, p. 138)

The preceding descriptions, based largely in traditional teachings and personal experience, suggest the role of several distinguishable mental abilities. They all mention either awareness or attention and a focus on the present moment. This suggests that a mindful person can control his or her attention, and many authors have described how attentional control can be developed through practice (e.g., Kabat-Zinn, 1984).

Gunaratana and Kabat-Zinn both describe or refer to a suspension of certain mental processes in mindfulness. Paying attention “nonjudgmentally” (Kabat-Zinn, 1984) relates to Gunaratana’s mention of awareness without “cognizing the perception, labeling it” (Gunaratana, 2002, p. 137). Definitions of mindfulness developed outside the field of

psychology describe conscious attentional control, awareness of experience in the present moment, and an inhibition of verbal processing, or at least an awareness of verbal processing as distinct from preverbal perception.

For researchers to study mindfulness, an operational definition has been needed. Bishop et al. (2004) have developed a definition comprising two components: maintaining attention on immediate experience through self-regulation, and adopting an attitude of curiosity, openness, and acceptance toward immediate experience. Self-regulation of attention requires the ability to sustain attention and to intentionally switch the focus of attention from one object to another. The use of these skills enables the “letting go” of thoughts and the redirection of awareness to immediate experience. Mindfulness practice enhances the practitioner’s ability to “inhibit secondary elaborative processing,” that is, to focus attention less on thoughts about experience and more on direct experience (Bishop et al., 2004). This definition shares with the other definitions the elements of conscious attentional control and focus on immediate experience (i.e. present moment experience). Additionally, Bishop et al. describe an attitude of acceptance, and in their discussion of the definition they describe an inhibition of verbal processing associated with mindfulness. Overall, the Bishop et al. definition of mindfulness shows a high level of consistency with at least some traditional definitions of mindfulness, and it includes an emphasis on attentional control and awareness of present moment experience.

One purpose of an operational definition is to facilitate agreement among researchers as to what they are researching. It is not yet clear that researchers have widely accepted the Bishop et al. definition. Hayes and Shenk (2004), though overall considering

the Bishop et al. definition “an advance,” (p. 251) found some limitations. Among these limitations, they noted that “the link to basic science is somewhat underdeveloped” (Hayes & Shenk, 2004, p. 251). Additionally, Hayes and Shenk (2004) noted that the operational definition assumes a view of “attention” as a “mental faculty” (Hayes & Shenk, 2004, p. 251) independent of the objects of attention and other situational factors. From this perspective, attention is described as something that can be “allocated in large or small amounts...or directed toward one event or another” (Hayes & Shenk, 2004, p. 251). This description, according to Hayes and Shenk, contains some philosophical bias in favor of a cognitive perspective rather than a behavioral one. Regardless of whether mindfulness is defined in cognitive or behavioral terms, researchers need behavioral measures of changes in attention to study mindfulness experimentally. According to Bishop et al., mindfulness involves the use of attentional control to increase awareness of present moment experience. One way researchers could study the effects of mindfulness would be to investigate mindfulness practitioners’ performance on a task requiring awareness of present moment experience.

Mindfulness Practice

Mindfulness practice is thought to alter the way practitioners pay attention (Segal, Williams, & Teasdale, 2002). The relationship between various types of mindfulness practice and changes in attention, whether the changes appear as a state or a trait, has not been demonstrated or specified through research. Bishop et al. (2004) proposed that mindfulness is a “mode of awareness”, or a state-like quality, rather than a trait, because it involves actively and intentionally regulating attention. Within the spiritual tradition of mindfulness practice, it is believed one can attain increasingly sustained mindfulness. For

example, according to Gunaratana, mindfulness or vipassana meditation is “a set of mental activities aimed at experiencing a state of uninterrupted mindfulness” (Gunaratana, 2002, p. 137). Practitioners generally understand this to be an aim of practice that few, if any, achieve. It has been proposed that persons can increase the amount of time they spend paying attention mindfully by practicing (Baer, 2003; Kabat-Zinn, 1994; Segal et al., 2002). With increased practice, a person spends more time consciously aware and less time unconsciously daydreaming or reacting (Kabat-Zinn, 1994). Forms of practice include objectively observing thoughts and feelings throughout the day (Linehan, 1993) and engaging in ordinary activities while bringing mindful awareness to the experience (Linehan, 1993; Segal et al., 2002). Perhaps the most widely used form of mindfulness practice is mindfulness meditation, in which a person consciously observes phenomena as they enter awareness. The study of mindfulness meditation might show empirically whether practice increases skill, and if so, what skills are increased by what particular practices.

For research purposes, there is no consolidated definition of mindfulness meditation. In *Mindfulness Based Cognitive Therapy for Depression* (Segal et al., 2002), and in the program on which it was based, *Mindfulness Based Stress Reduction* (Kabat-Zinn, 1990), several practices are taught, including yoga. The meditation exercises that are used include those in which the individual begins by focusing attention on the experience of breathing, then brings awareness to other aspects of experience such as bodily sensations, sounds and thoughts. Throughout the exercises individuals are instructed to observe aspects of experience in the present moment, as they occur, and with detachment. For example, individuals are instructed to observe thoughts as though

they are moving across a movie screen. Individuals are also instructed to take note and then let go of any distractions (Segal et al., 2002).

Little research has been done on specific effects of mindfulness practice. Some researchers have shown that various forms of meditation, including mindfulness meditation, develop specific cognitive skills or processes, such as sustained attention (Valentine & Sweet, 1999), metacognitive awareness (Wells, 2002; Teasdale et al., 2002), distractibility (Rani & Rao, 1996), flexibility in thinking (Kubose, 1976), field dependence (Linden, 1973), and exposure (Kabat-Zinn et al., 1992). Langer has done extensive research on her concept of mindfulness, which is related to but distinct from mindfulness as it is being discussed in this paper, and which includes active categorization of experience (Langer, 2000). Findings in studies of cognitive effects of meditation relate to common assumptions about how mindfulness practice can produce relief from psychological distress. For example, the more a person can sustain attention, the more the person can benefit from exposure procedures, in which the person must remain focused on anxiety-producing stimuli to achieve desensitization (Baer, 2003). Further research is needed to understand the specific effects of mindfulness practice.

Research on Mindfulness

Although little research has been done on the effects of mindfulness practice, some researchers have investigated characteristics of mindful individuals by developing and validating mindfulness questionnaires. Through research on mindfulness measures, researchers are increasing our knowledge of behaviors and cognitive processes associated with mindfulness. Baer, Smith, Hopkins, Krietemeyer & Toney (2006) performed factor analysis on a combination of five mindfulness questionnaires, resulting in a five factor

model. The factors were labeled “describe,” “act with awareness,” “nonjudging,” “nonreactivity,” and “observe.” All five factors loaded significantly on the overarching mindfulness factor, except for observe, which loaded on mindfulness for meditators but not for non-meditators.

The “observe” factor in the Baer et al. (2006) study was described as a measure of noticing or attending to experience. The researchers found a difference between meditators and non-meditators on this factor. Additionally, Baer et al. (2006) found that among non-meditators, Observe was negatively correlated with Nonjudging, whereas those two factors were positively correlated in a sample of meditators. Baer et al., (2006) found more differences in correlations between Observe and other factors when comparing meditators and non-meditators. For example, Observe was positively correlated with measures of dissociation, absent-mindedness, psychological symptoms, and thought suppression for non-meditators, but there was no correlation between Observe and those characteristics for meditators. According to Baer et al. (2006), these findings might suggest that Observe is uniquely sensitive to changes effected through mindfulness practice.

The five factor model that emerged from Baer et al.’s (2006) research defines facets of mindfulness. To the extent researchers can measure changes in each facet related to mindfulness practice, the five factor model provides a basis for developing testable hypotheses. One area worthy of further research is the effect of mindfulness practice on how practitioners notice and attend to experience.

Mindfulness practice is presumed to bring about changes in the way practitioners pay attention. It is presumed that by paying attention to present moment experience

during practice mindfulness practitioners improve their ability to stay mindful throughout the day. Mindfulness meditation is a way to develop mindfulness, and some research supports the notion that the practice of mindfulness meditation increases dispositional mindfulness, that is, the likelihood of the practitioner showing mindfulness at any given moment. Brown and Ryan (2003) found a group of Zen practitioners showed higher Mindful Attention Awareness Scale (MAAS) scores than non-Zen members of the general community. Additionally, higher MAAS scores were associated with more years of practice, and members of the Zen community who were regular meditators at the time of the study showed higher scores than non-meditating members of the Zen community.

Zen practice is not the same as mindfulness, though Zen practice includes mindfulness training along with other types of training. The results of the Brown and Ryan (2003) study suggest that Zen practice increases mindfulness, but does not show what aspects of Zen practice might have produced the effect.

Some research suggests that meditation is not the only way to increase mindfulness. Brown & Ryan (2003) found that people with no meditation experience vary in their degree of mindfulness as measured by the MAAS. They reported that people who do not practice mindfulness vary in their degree of mindfulness. Additionally, and incidental to the purpose of their research, Brown and Ryan (2003) found a group of cancer patients with no meditation experience had higher MAAS scores than other groups of non-meditators. The authors suggest perhaps “the experience of cancer acts to heighten attention to present-moment experiences and concerns” (Brown & Ryan, 2003, p. 843). Various experiences might affect mindfulness, and various methods exist for deliberately

cultivating it. There is no research comparing meditation with other methods. Meditation is the most researched method.

Mindfulness practice has been found to affect practitioners' attention as they go about their lives. Brown and Ryan (2003) studied the relationship between dispositional and state mindfulness. Their participants took the MAAS at the beginning of the study. During the study participants were randomly paged three times a day within certain blocks of time. There were two samples used in the study: one participated for 14 days, the other for 21. When paged, participants completed a version of the MAAS designed to measure state mindfulness. They also filled out the Perceived Locus of Causality scale, described as a measure of self-directed behavior, and they filled out a measure of emotional state. The trait MAAS predicted more autonomy and less intensity and frequency of negative affect. Trait MAAS scores did not predict frequency or intensity of positive affect. Higher trait mindfulness was associated with higher state mindfulness. State mindfulness was associated with higher levels of autonomy, more intense and more frequent positive affect, and less intense and less frequent negative affect.

The results of the Brown and Ryan (2003) study, while showing some difference between trait and state mindfulness, support the hypothesis that dispositional mindfulness predicts a greater frequency of state mindfulness. Additionally, the results provide information about psychological benefits of practice. One limitation of the study is its reliance on self-report measures. The present study attempts to measure a lasting effect of mindfulness practice by comparing meditators' and non-meditators' performance on a task.

REVIEW OF THE LITERATURE ON COGNITIVE EFFECTS OF MEDITATION

The present study is an investigation of a possible cognitive effect of mindfulness meditation, predicted on a theoretical basis. Little research has been done specifically measuring the effects of mindfulness practice. Researchers have discovered cognitive effects of various meditation practices. In the following review I will summarize those findings and discuss what they tell us about mindfulness practice.

Research on meditation has involved different types of meditation. Linden (1973) found that 8-11 year-old children showed reduced field dependence after meditating twice a week for 18 weeks. Field dependence was measured using the Children's Embedded Figure Test (CEFT), on which the children had to discern a figure within a distracting background.

Linden (1973) chose to study field dependence because "'field independence' reflects a general disposition to perceive and think in an articulated as opposed to a nonanalytic fashion (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962). Meditation practice trains the individual to focus his attention on an object or process ('figure') and to resist distraction from other sources of stimulation ('background')" (Linden, 1973, p. 139).

Linden (1973) used a total of 90 third grade children divided into 3 treatment conditions: meditation group, guidance group, and a group remaining with the rest of the class and receiving no special attention outside the classroom. Fifteen boys and 15 girls were assigned to each condition. The study was performed in a school in a

“disadvantaged neighborhood” (Linden, 1973, p. 140), About half of the participants were Black, and the rest were Puerto Rican. All participants were third graders. All had been promoted from second to third grade based on reading scores. Most participants were given the CEFT before and after treatment; 12% of participants were also given the CEFT before the end of treatment to ensure the researcher could still apply the norms for eight-year-olds.

Participants in the guidance group met with the guidance counselor for 45 min. once per week for 18 weeks. In these meetings the guidance counselor talked to the students about study skills. Participants in the meditation group met twice per week for 20-25 minutes over the same 18-week period. At each session they meditated for 10-15 min., took a break, then meditated again for 5-10 min. Analysis of covariance revealed no significant pretest difference among the groups on CEFT scores but revealed a significant difference among the groups at posttest, with the meditation group showing the highest scores. Post-hoc analysis revealed that the meditation group was significantly different from the other two groups, whereas the other two groups did not differ significantly from each other.

The results of the Linden (1973) study suggest that meditation can affect attention and perception after 18 weeks of practicing twice per week. Field dependence, the effect measured in this study, appears related to the ability to manage distractions and focus on an object; therefore, the findings suggest that the meditators in the study improved their attentional control. The meditators in this study appeared to have developed this skill through a practice similar to ones used in Mindfulness Based Cognitive Therapy (MBCT) (Segal et al., 2002), whereby they were instructed to maintain attention on the breath and

body sensations. The Linden (1973) article is brief and contains no discussion of the relationship between field dependence and other cognitive abilities, nor does it discuss the implications of the results for understanding the benefits of meditation practice. Further research is needed to understand the relationships among meditation generally, mindfulness practices, and related cognitive abilities.

By studying and comparing meditation types, researchers can illuminate the effects of specific aspects of practice. Meditation research could provide information about persons' abilities to cultivate mental change. Linden did not specify what type of meditation his participants practiced. When the children in the study were about to meditate, they were instructed to "keep your full attention within yourself...keep your mind on whatever you are experiencing... if your mind should go off the track and you find yourself watching or thinking something else, gently let go of what you are seeing or hearing and bring your attention back to yourself breathing" (Linden, 1973, pp. 140-141). These instructions are similar in some ways to the instructions for the mindfulness techniques used in MBCT (Segal et al., 2002).

The instructions for the mindfulness exercises used in MBCT provide a useful basis for comparison with the instructions in the Linden (1973) study. Individuals going through the MBCT course practice a variety of mindfulness exercises, including mindful walking, body-scan meditation, mindfulness of sounds, and mindfulness of the breath and body. Instructions for mindfulness of the breath and body in MBCT include the suggestion that when "awareness has drifted away from the sensations in the body...gently note where your mind was...and kindly focus your attention back to your breathing and to a sense of your body as a whole" (Segal et al., 2002, p. 157). In these

instructions and in the instructions from the Linden study participants are instructed to focus on experiences arising within themselves and are told to gently or kindly let go of distractions.

Compared with the instructions given the children in the Linden study, the MBCT instructions are more specific. In both instances, practice involves focusing within; the MBCT instructions include specific instructions to focus on body sensations. In MBCT, participants learn about and discuss various aspects of mindfulness, such as acceptance of unpleasant experiences; in the Linden (1973) study, the participants' only understanding of the exercise was based on the instructions given at each meditation session, unless they entered the study with prior knowledge, a variable not mentioned in the study. In MBCT, the group facilitator provides verbal instruction or cues throughout most exercises, whereas in the Linden (1973) study participants were only given instructions before practice. It is unknown how individual meditators might respond differently to different sets or types of instructions on different occasions. However, there are significant similarities between the meditation described in the Linden (1973) study and the exercises practices in MBCT. Among those similarities are instructions to attend to present-moment experience.

The results of the Linden study (1973) showed that participants were able to increase their field independence through short-term mindfulness practice. Field independence relates to effective control of attention and management of distractions, abilities closely related to the proposed benefits of mindfulness practice.

A study by Valentine and Sweet (1999) compared mindfulness and concentrative meditators on a task of sustained attention. The researchers also compared long-term (25

months experience or more) with short-term meditators (24 months experience or less). Valentine and Sweet (1999) recruited 8 male and 11 female meditators from a Buddhist center. Meditators ranged from 29 to 43 years old with a mean age of 32.9. Meditators were divided into mindfulness and concentrative groups based on which of two statements they endorsed about their meditation practice. Participants who endorsed the following statement were considered mindfulness meditators: "I expand my attention/awareness to as many possible events as possible [sic]. I consider nothing to be a distraction. Any new event physical or mental is considered by me to be part of my meditation." Participants placed in the concentrative group endorsed this statement: "I focus my attention as far as possible to a single point - a mental image, a perceptual object, breath or sound or thought. I try and concentrate solely on this one item to the exclusion of everything else." Meditators were assigned to one of four groups based on length of meditation experience and type of meditation; there were between 4 and 6 participants in each group.

Participants in the control group were 24 college students "selected to be comparable in intellectual level with the meditators" (Valentine & Sweet, 1999, p. 64). They ranged in age from 19 to 24 with a mean age of 22. They had no meditation experience.

All participants performed The Wilkins' Counting Test, which consists of tape recorded bleeps that occur at different rates. There are five sets, each consisting of 12 "trains" of bleeps ranging from 2 to 11 bleeps. Examinees are instructed to count the bleeps and at the end of each series report the number presented. In their study, Valentine and Sweet (1999) used the first two and the fifth set. In the first two sets the bleeps come

much more slowly than in the fifth set. Controls heard the first two sets; meditators heard all three. Mindfulness meditators were instructed to “adopt their usual meditative technique” (Valentine & Sweet, 1999, p. 65) while performing the task, and concentrative meditators were instructed to focus their attention on the auditory stimuli.

The researchers hypothesized that the meditators would count the bleeps more accurately and therefore show greater sustained attention than the controls. They also hypothesized that long-term meditators would outperform short-term meditators in counting accuracy. Additionally they hypothesized that, compared with concentrative meditators, mindfulness meditators would maintain accurate counting when moving from the slower bleeps of the first two sets to the faster bleeps of the fifth set. They predicted this based on the assumption that when the rate of bleeps suddenly increased, the concentrative meditators would have to shift their attention, causing their focus to decrease. In contrast, mindfulness meditators would not show a decrease in focus because their attention would be “distributed” (Valentine & Sweet, 1999, p. 62).

The results were consistent with what the researchers predicted. Meditators were more accurate than controls. Long-term meditators outperformed short-term meditators. Mindfulness and concentrative meditators did not differ in performance on Sets 1 and 2, but mindfulness meditators outperformed concentrative meditators on Set 5. Additionally, meditators showed less of a decrease in performance over time during the task compared with controls. The researchers also noted an interesting incidental observation: Many participants in the control group called the task “boring,” whereas none of the meditators did.

Valentine and Sweet (1999) demonstrated that meditation improves sustained attention. They effectively operationalized the difference, or at least an aspect of the difference, between mindfulness and concentrative forms of meditation. The quality of mindfulness they measured has been called “receptivity” or “flexibility” of attention. The meditators in the Valentine and Sweet (1999) study were instructed to apply their respective meditation techniques to the task. The researchers measured the meditators’ ability to intentionally apply their meditation skill; they did not look at general changes in attention that meditation practice might affect.

Dunn, Hartigan and Mikulas (1999) compared short-term concentrative and mindfulness meditators on their EEG patterns. In their study, 10 college students taking a psychology class underwent 10 weeks of meditation training, half of which was devoted to concentration meditation and half to mindfulness. Throughout the 10 weeks the students meditated five times per week, starting with 10 min. of meditation, gradually building to 30 min. Mindfulness practice began with 3-5 min. of concentration practice.

Participants’ brain activity was recorded by 19-point EEG before the course of meditation to familiarize participants with the procedure. At that time participants were instructed to close their eyes and relax during the EEG. After the course of meditation, participants’ brain activity was again measured by EEG. Each participant performed three tasks: relaxation, mindfulness meditation and concentration meditation. Between and within-subject counterbalancing was used to control for order effects.

Data collection began after each participant said “okay,” indicating he or she had reached at least a 2 on a 10-point scale of “depth” (Dunn et al., 1999, p. 152) of relaxation or meditation, 10 indicating the greatest depth. At variable intervals, averaging

about 90 sec., throughout each task the experimenter said “state,” at which point participants had to rate their depth of relaxation or meditation on the 1-10 scale. All participants reported that they did not find the rating procedure distracting. All participants also reported they were able to attain the requested state and maintain it for the required 15-min.

The researchers analyzed the amplitude of brain activity at each of the traditional bandwidths (alpha, beta 1, beta 2, delta, and theta) at each of the 19 recording sites. They compared mean amplitudes for each bandwidth at each site across conditions and reported significant interaction effects of condition and site.

Relaxation produced more slow-wave activity over large areas of the cortex than either meditation condition. Differences were found over the entire cortex when relaxation was compared with concentration, whereas they were found in the central and anterior cortex when relaxation was compared with mindfulness. Mindfulness meditation was associated with greater relatively slow wave activity in some cortical regions and greater fast wave activity in other regions compared with concentration. According to the authors, these results might reflect the combination of calm and alertness described by mindfulness meditators.

The Dunn et al. (1999) study provides evidence that meditation produces measurable changes in brain activity, that meditation is distinct from relaxation, and that concentrative and mindfulness meditation practices differ significantly. The study examined short-term meditators while they were meditating. Further research is needed to examine effects of practice on non-meditative functioning. Additionally, the researchers acknowledged that although the results appeared to show distinct patterns of cortical

activation for each of the three investigated states, there remains a possibility that the difference is quantitative rather than qualitative. However, the findings appear consistent with an understanding of mindfulness as a state of calm alertness. The findings also support a relationship between subjective reports of meditation experiences and specific changes in brain activity.

Researchers have found evidence that mindfulness, concentration, and relaxation are three distinguishable experiences. The research distinguishing concentration from mindfulness suggests it might be possible to define broadened versus focused attention scientifically in terms of brain activity and performance on attention-related tasks.

Other research has shown that Transcendental Meditation, which is primarily a concentrative form (Dunn et al., 1999), improved children's attention regulation as measured by the Star Counting Task (Rani & Rao, 1996). Davidson, Goleman, & Schwartz (1976) showed that length of meditation practice was associated with higher scores on the Tellegen Absorption Scale, considered a measure of "fully engaged attention." However, Brown and Ryan (2003) found scores on the MAAS, measuring mindful awareness, to be negatively correlated with scores on the Tellegen Absorption Scale, and they described the Absorption Scale as measuring "a disposition to enter transient altered states of consciousness" (Brown & Ryan, 2003, p. 828).

Overall, researchers have found support for the hypothesis that individuals can improve their attentional control through meditation practice. Through a practice similar to mindfulness, individuals increased their ability to differentiate a figure from a distracting background (Linden, 1973), perhaps related to increased attentional control and ability to note distractions without shifting focus. Researchers have also found

evidence that, compared with individuals practicing concentration, those practicing mindfulness more effectively respond to changes in stimuli, perhaps because of their broader scope of awareness, whereby they do not have to shift their attention in response to changes (Valentine & Sweet, 1999). Mindfulness and concentration practices were also shown to produce characteristic EEG patterns (Dunn, Hartigan, & Mikulas, 1999). Lastly, researchers have shown ways in which changes in attention increase with years of practice (Valentine & Sweet, 1999).

Effects of Long-Term Practice

Individuals have developed and used techniques other than meditation to develop mindfulness. In MBCT (Segal et al., 2002), participants are instructed to walk slowly and attend to the experience of walking in each successive moment. Also in MBCT (Segal et al., 2002), participants mindfully eat a raisin. In Dialectical Behavior Therapy (DBT) (Linehan, 1993), participants are instructed to attend mindfully to ordinary experiences, such as “your fanny on the chair,” (p. 67). They are also provided with various instructions and metaphors to help them apply mindfulness to their daily lives, such as “have a ‘teflon mind,’ letting experiences, feelings, and thoughts come into your mind and slip right out” p. 111). Little or no research has been done on the effects of individual techniques within MBCT or DBT. To date, meditation is the most well-researched mindfulness technique.

It is difficult to distinguish the effects of meditation generally from the specific effects of mindfulness meditation. Some research has shown differences between meditators of different levels of experience. Shapiro (1992) observed several progressive changes when comparing vipassana meditators of different lengths of practice. Those

who meditated the longest reported the fewest self-critical cognitions about not practicing when they did not practice. Brown and Engler (1980) looked at Rorschach responses made by meditators who were divided according to qualitative stages of meditation experience. Participants showed characteristic responses according to their stage, and they showed differences between stages in the amount and quality of responses they produced (Brown & Engler, 1980). In a more recent study, Davidson et al. (2003) found participants in a mindfulness meditation training program showed baseline differences in brain and immune function after the course. Participants showed increased left-sided anterior activation compared with the control group, a pattern found in previous research to be associated with positive affect. Participants also showed a stronger immune system response to an influenza vaccine. The research strongly suggests that mindfulness meditation produces measurable changes that might increase with practice over time.

Researchers have variously defined mindfulness and have demonstrated many of its benefits. Some studies have shown positive outcomes for treatment programs containing mindfulness practices derived from traditional methods (e.g., Segal et al., 2002). One study has shown mindfulness positively associated with well-being and with years of Zen practice. Researchers have investigated the effects of meditation practice (e.g., Linden, 1973). Many of the meditation studies have investigated Transcendental Meditation (TM); others have investigated “meditation” without differentiating types of meditation or specifying which type was used. Researchers have considered mindfulness meditation an effective way but not the only way to develop mindfulness, and have recognized that mindfulness is to be practiced throughout the day (Brown & Ryan, 2004). Further research is needed to discover the relationship between specific practices and the

cultivation of mindfulness. Also, further research can show how mindfulness practice affects aspects of functioning throughout the day. The present study was designed to investigate the relationship between mindfulness meditation practice and an aspect of cognitive functioning related to how people attend to and remember events.

Research findings support the hypothesis that people can learn better control over their attention through meditation. It has been proposed that people can reduce their clinical distress through mindfulness practice, partly because they increase their awareness of their thoughts and feelings (Segal et al., 2002; Linehan, 1993). Baer et al. (2003) found 5 factors related to mindfulness, which, for meditators, included Observe, described as noticing or attending to experience. In the next section I will introduce the concept of source attribution, a cognitive process that partly relies on noticing aspects of one's experience of an event (Sherman & Besenoff, 1999). The present study is designed to examine whether mindfulness practice increases the accuracy of source attributions.

A PROPOSED RELATIONSHIP BETWEEN MINDFULNESS AND SOURCE ATTRIBUTION

“Source attribution” is defined as the ability to discern the source of information stored in memory (Sherman & Besenoff, 1999). Most of the research conducted on source attribution has related to eyewitness testimony, the accuracy of which is thought to depend on witnesses making accurate source attributions. It seems possible that individuals might make more accurate source attributions the more mindfully they were attending to the event. By researching the effect of mindfulness on source attributions we can learn more about the processes involved in both mindfulness and source attributions. In the following review of the literature on source attributions and eyewitness testimony I will describe attentional processes involved in making accurate source attributions that individuals might develop through mindfulness practice.

Researchers investigating eyewitness testimony have studied factors affecting where witnesses direct their attention. They have also shown how witnesses’ focus of attention affects the accuracy of their recall. Wells and Olson (2003), in their review of the literature on eyewitness testimony, described ways in which the type or amount of attention a witness pays during an event affects the accuracy of the witness’s identification of a culprit’s face. In a study by Lieppte (1978, cited in Wells & Olson, 2003) participants witnessed a theft of a package. Some participants were told the package contained something valuable, whereas others were told it contained something trivial. Additionally, some participants were told the contents of the package before the

event, whereas others were told after. Those who were told the package was valuable before the event were the most accurate in identifying the culprit. According to the authors, participants paid more attention to the culprit and therefore identified him more accurately when they believed he was carrying something valuable.

In another study by Wells & Hryciw (1984, cited in Wells & Olson, 2003), some witnesses made abstract inferences about a culprit, such as considering whether the person looked honest. Other witnesses made physical judgments, such as whether the person's nose was large or small. Witnesses who made abstract inferences made more accurate identifications, presumably because they engaged in more holistic processing of the culprit's facial features.

Studies on eyewitness testimony have shown a relationship between individuals' focus of attention during an event and which aspects of an event they recall most accurately and in the most detail. It is unknown how individuals experience and recall events differently when they attend to the event mindfully. Specifically, it is unknown whether individuals attending mindfully notice more aspects of their external environment or if they only or primarily notice more aspects of their internal experience. In making accurate source attributions, individuals rely on both. Looking at the Lieppte (1978, cited in Wells & Olson, 2003) and Wells & Hryciw (1984, cited in Wells & Olson, 2003) studies, one can consider ways individuals might perform when they attend mindfully.

Lieppte (1978, cited in Wells & Olson, 2003) found that participants more accurately identified an individual in post-event questioning when they had directed their attention to that individual during the event. When individuals attend mindfully, they

attend more broadly to their experience (Segal et al., 2002). If this means they broadly notice their physical environment, they would be less likely to focus on specific aspects of an event. Therefore, in the Lieppte (1978, cited in Wells & Olson, 2003) experiment, if individuals had been attending mindfully they would have identified the culprit with equal accuracy regardless of information about what he was carrying. On the other hand, individuals paying attention mindfully, and therefore “on purpose” (Kabat-Zinn, 1990), might consciously decide to attend more to the culprit, knowing he is carrying something important.

Wells & Hryciw (1984, cited in Wells & Olson, 2003) found that individuals more accurately identified faces after presumably processing the faces holistically, which suggests that the individuals attended to the faces holistically. If attending mindfully means broadly noticing environmental details, a person attending mindfully would likely notice many aspects of the faces, along with their thoughts and feelings while observing the faces. This would lead to more accurate recall, given that holistic processing leads to more accurate recall of faces.

When people pay attention mindfully, they presumably attend to more aspects of their experience (Segal et al., 2002). If individuals attending mindfully notice more aspects of their external environment, they will attend to and recall more details of an event. If mindfulness affects accuracy of recall, it will also affect source attributions. Next I will discuss the characteristics of a person’s recall that have been found useful for making accurate source attributions.

Witnesses more accurately recall aspects of an event to which they were paying more attention and to which they devoted more cognitive resources (Wells & Olson,

2003). Accurate source attributions depend on the accuracy and detail of witness' recall. Source attributions are made partly on the basis of "the nature and amount of characteristics in the memory that reflect the conditions under which they were acquired" (Zaragoza & Lane, 1994, p. 935) (e.g. contextual information and emotional reactions). Individuals who have participated in mindfulness training have shown greater sustained attention (Valentine & Sweet, 1999) and report greater awareness of experience (Brown & Ryan, 2003). Additionally, practitioners of mindfulness have described developing broader and more stable awareness (Gunaratana, 2002). Researchers believe that when individuals pay attention mindfully, they notice more aspects of their experience (Segal et al., 2002). There is little empirical research investigating this assumption, and it is not known to what extent individuals notice more about their environment when they pay attention mindfully. If individuals paying attention mindfully notice more aspects of their experience, including aspects of their environment, when they mindfully attend to an event, they will notice and therefore remember more aspects of the event. Mindfulness practice, by broadening one's awareness of various aspects of experience, might increase individuals' likelihood of noticing and remembering aspects of experience useful in making accurate source attributions.

A link exists between mindfulness and source attributions through research on autobiographical memory. According to Sherman and Besenoff (1999), for individuals to accurately report autobiographical memories they must correctly discern whether they or someone else did the remembered behaviors. Williams et al. (2000) found that the autobiographical memories of depressed patients contain fewer details and more generalities than those of non-depressed people. Researchers also have found that

formerly depressed persons who participated in Mindfulness-Based Cognitive Therapy increased the specificity of their memories, in contrast to formerly depressed persons who did not participate in the program (Williams et al., 2000).

According to Williams et al. (2000), overgeneral autobiographical memory reflects a cognitive style characteristic of individuals who have been depressed. Because depressed individuals often use mental resources to avoid unpleasant memories, they disrupt their retrieval process and fail to recall details. Alternately, depression-prone persons use an overgeneral retrieval style to reduce the impact of emotional material. Through participation in a mindfulness-based treatment program, formerly depressed individuals increased the specificity of their autobiographical memories, though they did not decrease their depression scores. Formerly depressed individuals who participated in treatment as usual showed no increase in the specificity of their memories.

When a person's memories are vague, the person is more prone to source misattributions (Johnson et al., 1993). According to Williams et al. (2000), through mindfulness practice, individuals increase the specificity of their memories by learning to notice more aspects of their experience. They encode and retrieve more details. Individuals must encode details and effectively retrieve memories to make accurate source attributions. Depressed persons can decrease their proneness to depressive relapse through mindfulness practice, presumably by increasing their awareness of relapse signs and of alternate perspectives on experiences (Segal et al., 2002). Persons who have been depressed are often poor source monitors because they fail to encode and retrieve sufficient details of events. Through mindfulness practice, those individuals can learn to encode and retrieve more detailed memories (Williams et al., 2000).

Individuals make a variety of errors in their encoding and recollection of events. Depressed persons often show a bias toward information supporting a negative view of themselves and of situations (Segal et al., 2002). In other situations individuals show a bias toward information confirming their assumptions or stereotypes (Sherman & Besenoff, 1999). Research on eyewitness testimony and false memories suggests that persons can believe they witnessed or experienced events that never happened (Zaragoza & Lane, 1994). Researchers have found that anxiety can negatively impact source attributions through its effect on memory processes. When anxious, individuals might divert mental resources away from encoding and retrieving accurate information toward managing or reacting to the anxiety (Eysenck & Calvo, 1992), reducing the accuracy of their source attributions. However, Ridley, Clifford and Keogh (2002) found that individuals are less susceptible to misleading information the more trait anxiety they show. The researchers concluded that the anxious participants, because they were more vigilant, noticed and more actively processed the discrepancy between what they saw and the misleading information they encountered in the post-event questioning. One likely source of the discrepancy between this and the previous finding is that Eysenck and Calvo (1992) studied state anxiety, whereas Ridley, Clifford and Keogh (2002) studied trait anxiety.

Both mood and cognitive factors contribute to focusing on certain stimuli at the exclusion of others, which can contribute to source misattributions. Narrowly focused attention is adaptive in many situations but not in others. In some cases, such as depression or confirmatory bias, individuals' focus of attention is strongly influenced by their immediate affective or cognitive bias (e.g., negative thoughts or information

confirming beliefs). As a result, they give inadequate consideration to incoming information or to other aspects of subjective experience. Mindfulness practice involves broadened awareness of internal experience, and mindfulness throughout the day involves a balanced awareness of internally and externally originating phenomena as they occur (Brown & Ryan, 2003). This balanced awareness might facilitate accurate source attributions.

When persons who witness events such as crimes or accidents are asked to recall what they witnessed, they often must distinguish their memories of the event from information to which they were exposed after the event. According to Johnson, Hashtroudi, and Lindsay (1993), memories are more likely to be judged as originating from experienced events when they contain perceptual and contextual details, and when they include information about cognitive operations related to the event. Cognitive operations include thoughts about the event when it occurred, such as naming the type of event or considering the meaning of it. Researchers believe that when individuals attend mindfully, they observe and increase their awareness of thoughts and feelings (Segal et al., 2002; Kabat-Zinn, 1994). If this is the case, the more individuals pay attention mindfully during an event, the more they will notice their reactions to the event that might prove useful in making accurate source attributions about the event.

According to Johnson et al. (1993), individuals rely on sensory/perceptual information, semantic detail, affect, and cognitive operations as cues for making source attributions. The ability to make accurate source attributions is determined by the type and amount of cues included in the memory, whether cues from different sources are easily distinguishable, and the judgment processes individuals use to make source

decisions, including the criteria they use (Johnson et al., 1993). Based on what is currently known and understood about mindfulness, when individuals attend mindfully to an event and to their experience of recalling the event, they will likely access more useful cues about the source of the memory. They also will likely observe their retrieval process, and might notice whether they are using effective criteria for making source attributions.

It has been hypothesized that the accuracy of source attributions is affected by the quality of witnesses' attention during an event and the amount and quality of detail they encode. Accuracy is also affected by cognitive processes engaged during the event and at time of recall (Johnson et al., 1993). If during an event a witness employs narrow or divided attention, the witness would likely miss details or fail to observe cognitive processes useful for making accurate source attributions later. Mindfulness practice, by broadening practitioners' awareness, might increase the accuracy of their source attributions.

Following is a brief review of general findings from studies on source attribution. This will be followed by a detailed discussion of studies more directly related to the present one.

A REVIEW OF THE LITERATURE ON SOURCE ATTRIBUTION

Several studies have shown that individuals remember more perceptual and contextual information from events they have experienced than from those they have imagined. Individuals might make some source attribution decisions partly based on differences in the amount of these memory characteristics, particularly when distinguishing experienced from imagined events (Johnson et al., 1993). Source confusion increases when memories from external and internal sources share significant perceptual features. For example, in a study by Johnson, Foley, and Leach (1988), participants imagined hearing words spoken either in their own voice or a confederate's. Participants also heard words spoken by the confederate. Participants who imagined the confederate's voice showed less ability to discriminate what they had imagined hearing from what they had heard. The Johnson et al. (1988) study is one of several showing source confusion increased by perceptual similarity between perceived and imagined events (Johnson et al., 1993).

Some research has shown participant characteristics to affect source attributions in one type of situation but not in another type. For example, older adults (Hashtroudi, Johnson, & Chrosniak, 1989) and children showed difficulty with internal source monitoring (discriminating among internally generated sources; e.g. between what one thought and what one said) but not external source monitoring (discriminating among externally generated sources). Harvey (1985) found that thought disordered manic participants showed difficulty with external but not internal source monitoring. Overall

the findings suggest that although all source-monitoring tasks likely involve shared cognitive processes, specific tasks involve some specific processes.

Conditions at time of recall can affect source monitoring. For example, Lindsay (1990) exposed participants to a misleading narrative after they viewed an event. Participants were instructed to report only what they had seen, not what they had read. Participants were more likely to report having seen aspects of the narrative when they read the narrative immediately after viewing the event, under conditions very similar to those under which they viewed the event. The results suggested three factors affecting source attributions: Individuals who know they are receiving verbal misinformation will still make source misattributions based on that misinformation; greater time between the event and the misinformation improves source attributions; and differences between conditions when individuals witness an event and receive misinformation about the event facilitate accurate source attributions.

Zaragoza and Lane (1994) performed five experiments in which participants viewed a sequence of slides depicting a theft. In each experiment, after participants viewed the slides, they were exposed to information related to but different from the slides, and they were asked to discriminate the different versions of the event. In the first experiment, participants viewed the slides and then read a narrative about the event, after which they answered questions about the event. Misleading information about the event was included in either the narrative or the questionnaire. The misinformation pertained to objects. For example, in one instance it was mentioned that the subject in the slides looked at his wristwatch, though in the slides he was not wearing a wristwatch. In the last phase of the experiment, after participants saw the slides, read the narrative, and

answered questions about the slides, participants heard a list of items and were instructed to indicate whether they had seen the item, read about the item, both, or neither. In the other four experiments the procedure was varied to control for demand characteristics and response bias.

Many participants reported having both seen an item in the slides and having encountered it in the written material when they had not seen the item. The researchers considered those participants to have believed they had seen an item that had only been suggested to them in the written material. The researchers also found that participants were more often misled when they answered questions containing the misinformation than when they read a narrative containing misinformation. The researchers concluded that the participants who answered the misleading questions engaged in more reflective and elaborative processes while encoding the suggestions and therefore encoded those suggestions in a way conducive to misattributing them to the perceived event.

Participants in the Zaragoza and Lane (1994) study were tested for recall immediately after they were presented with the information, providing little time for them to forget what they saw. In two of the experiments, participants indicated 72% to 76% of the time they definitely remembered reading the suggested material. The researchers concluded that individuals will often make source misattributions despite accurately remembering the original source of inconsistent information.

The findings in the Zaragoza and Lane (1994) study suggest that in some instances when individuals make inaccurate source attributions they believe they saw something they only read about. More generally, the findings suggest that sometimes source misattributions are made based on memories that have been altered to incorporate

the misinformation. The findings also suggest that when individuals actively process misleading information about a previously witnessed event, they increase their likelihood of incorporating the misleading information into their memory of the event.

No one has researched the effect of mindfulness on source attributions. Researchers believe individuals increase their awareness of subjective experience through mindfulness practice (Segal et al., 2002). This increased subjective awareness would likely affect individuals' performance differentially at each stage of an experiment like the Zaragoza and Lane (2004) study. When exposed to misinformation, mindfulness practitioners would likely notice their responses in ways that might help them avoid misattributing the information.

Mindfulness is considered to involve a reduction in elaborative processing (Bishop et al., 2004). Yet elaborative processing is considered helpful in making accurate source attributions. Mindfulness might decrease the accuracy of source attributions by decreasing practitioners' thoughts about experience, thoughts that might have proved helpful in organizing the information for later recall. Additionally, the mindful person might fail to have thoughts that later he or she would remember having; those thoughts would have been part of the memory, useful in making source attributions. Alternatively, mindfulness might increase accurate source attributions by increasing awareness of other useful aspects of experience. When misinformation is embedded in a question, a mindful person might notice various internal responses to the question before choosing to express a particular response. The response might include awareness of the misinformation, which the person avoids incorporating into his or her memory and future responses.

Ridley, Clifford, and Keogh (2002) studied the effect of children's trait anxiety on their susceptibility to suggestion through misinformation. Children are generally more vulnerable to the suggestive effects of misinformation; Ridley et al. hypothesized that children's trait anxiety would intensify the effect of state anxiety (likely a factor in eyewitness questioning) on suggestibility. The study is relevant partly because the present study is a replication of the design in the Ridley et al. study, as will be discussed later in this paper. Additionally, some of the purported effects of mindfulness would likely interact with other factors affecting source attributions, such as anxiety. Mindfulness has been negatively correlated with measures of both state and trait anxiety (Brown & Ryan, 2003; Kabat-Zinn et al., 1992).

Ridley et al. (2002) hypothesized that, because anxiety engages cognitive resources in non-essential processing (i.e., worry), it should interfere with both encoding and retrieval of memories. They discussed controversy on this point and cited research showing that anxiety can also increase on-task performance and effort. Additionally, anxiety increases vigilance and might increase sensitivity to misinformation. They hypothesized that the children in their study would differ in their suggestibility but did not predict in which direction they would differ.

The participants in the Ridley et al. (2002) study were 45 boys and 38 girls with a mean age of 9.9. In the statistical analysis, based on participants' scores on Spielberger's State-Trait Anxiety Inventory for Children (STAI-C), participants were placed into either the extreme high or extreme low anxiety group. Participants viewed a video of a minor car accident and its aftermath, taken from a British television show. After viewing the video the participants wrote answers to questions about details of the film. There were

two versions of the questionnaire, each containing 10 identical items and 5 that were different. On the misleading questionnaire, the five different questions contained misleading information (e.g., “was there blood on the yellow top the lady was wearing?” when the lady’s top was white). Of 64 participants, 33 received the misinformation questionnaire, and 31 received a questionnaire with no misleading information.

After completing the questionnaire the children completed Spielberger’s State-Trait Anxiety Inventory for Children and Bireleson’s Depression Self-Rating Scale for Children. Next, the children answered five more questions about the video. These questions were designed to test whether participants in the misled condition had been misled.

Ridley et al. (2002) found the overall number of the children’s correct responses to be uncorrelated with their number of misled responses. They concluded that their participants’ accuracy was unrelated to their suggestibility. The researchers also found that, whereas there was no correlation between anxiety and accuracy (overall number of correct responses), the high anxiety children were less suggestible than the low anxiety children, in contrast to previous research showing anxiety to be associated with increased suggestibility (Eysenck & Calvo, 1992).

The relationship between memory and suggestibility might vary depending on the task; the same might be true for the relationship between memory and anxiety. In this study, perhaps the high anxiety children generally were experiencing a level of anxiety that was sufficient to increase their on-task performance and effort but insufficient to provoke significant amounts of non-essential cognitive processing. Perhaps the effect of anxiety is different in children than in adults.

Ridley et al. (2002) suggested that the high anxiety children might have found the misinformation “threatening” (p. 555) because it differed from the information they had stored in memory. This detection of a threat might have led the high anxiety participants to process the misinformation more systematically. As a result, perhaps they showed more awareness of the discrepancy and avoided confusing it with what they observed.

Mindfulness has been described as a state of calm alertness. It has been reported that anxiety can cause people to be more attuned to misinformation and therefore less susceptible to suggestion. It has also been reported that anxiety can occupy attentional resources, as the anxious person engages in non-essential processing to manage the anxiety. If mindfulness is a state of calm alertness, and if mindfulness involves “inhibiting secondary elaborative processing” (Bishop et al., 2004, p. 233), then perhaps, in relation to source attributions, mindfulness gives the benefits of anxiety without the disadvantages. In other words, perhaps mindfulness practice increases one’s ability to effectively and efficiently pay attention, while increasing the sort of alertness needed to detect misinformation.

There is little research showing how mindfulness practice affects ordinary functioning. Varying circumstances require varied ways of paying attention; it is unknown how mindfulness relates to the way a person pays attention in different unexpected situations. For example, it is unknown how a relatively more mindful person would compare with a relatively less mindful person in a situation requiring accurate source attributions.

Hypotheses and research findings about source attribution suggest it involves abilities that might increase with mindfulness practice, including increased awareness of

internal responses to an event, attention to multiple aspects of the event, and awareness of one's cognitive processes during recall. In the present study I investigated whether there is a relationship between mindfulness practice and source attributions. The results have implications for understanding the cognitive effects of mindfulness practice and the processes involved in making accurate source attributions.

The present study was designed to examine whether mindfulness practice increases the accuracy of source attributions. In this study, practitioners of mindfulness meditation and non-meditators saw a short video and then immediately were asked questions about the video. The two groups were compared on their ability to discriminate between information that was in the video and misleading information imbedded in the questions about the video. The study is based on a similar experiment designed to measure suggestibility differences in high and low anxiety children (Ridley et al., 2002). It was hypothesized that meditators would score higher than non-meditators, showing more accurate recall. It was also hypothesized that meditators would show fewer misled responses, suggesting greater source attribution abilities than non-meditators.

METHOD

Participants

A total of 49 individuals participated. Participants came from several sources. A total of 28 (25 non-meditators and 3 meditators) were recruited from Pacific University in Portland, Oregon. Another 8 meditators were recruited from the Portland Insight Meditation Community (PIMC) in Portland, Oregon, and 13 meditators were recruited from the Great Vow Zen Monastery in Clatskanie, OR. Participants from Pacific University were recruited via an announcement posted to the student listserv, and also via flyers posted around the campus. Participants from PIMC were recruited via announcements posted to the PIMC listserv and announcements made by the investigator at PIMC gatherings. Participants from the Great Vow Monastery were recruited at the investigator's request by an administrator at the monastery.

Residents at the monastery and individuals who attend the PIMC practice mindfulness meditation. As part of their participation in the study, participants completed a demographics questionnaire that included a question asking them to describe their meditation practice. Through their responses they provided additional information about their practice, which often included other forms of meditation. Additionally, some individuals from Pacific University practiced meditation; on the demographic questionnaire these individuals described practicing mindfulness meditation.

Participants ranged in age from 18 to 49, with a mean of 35. Of the 49 participants, 45 (92%) described themselves as Caucasian. One participant reported being

“Caucasian and Hispanic.” Four participants described themselves, respectively, as “Italian/Irish American Caucasian,” “Eastern European Jew,” “Asian,” and “Middle Eastern.” Of the meditators, 14 (58%) were female, 10 (42%) male; of the non-meditators, 22 (88%) were female, 3 (12%) male. No volunteers were excluded from participation. Twenty-four participants were classified as meditators. Meditators ranged in years of meditation experience from 2 to 20 with a mean of 6.

Procedure

Non-meditators participated at Pacific University, with groups of between 3 and 6 participants, on one of six occasions. Meditators (other than those who participated at the University) participated at the Portland Insight Meditation Community building in groups of 1 to 3 participants on one of four occasions. Meditators from the Great Vow Zen Monastery participated on two occasions with 5 participants on one occasion and 8 on the second.

On each occasion the experiment was conducted in three phases. In Phase 1, participants viewed a 3-min. video, taken from the movie “A Family Thing,” in which two cars collide, the men in both cars get out, and the driver of one car is assaulted and robbed by the men from the other car. The video was selected partly because of the high likelihood that none of the participants would have seen it; none had. The video was also selected because it was rich in detail and presumed to be mildly stressful, increasing the likelihood participants would narrow their focus to the stressful aspects.

In Phase 2, the participants were given a questionnaire. There were 2 versions of the questionnaire: one that was misleading and one that was not. Twenty-two participants completed the misleading one, and 27 completed the non-misleading one. The two forms

had ten questions that were identical on each form. The misleading questionnaire had five questions containing misleading information, and the non-misleading questionnaire had five corresponding questions without misleading information. For example, one misleading question read, "The victim's wallet was in a back pocket of his tan khaki pants on which side?" The non-misleading version of the question read "The victim's wallet was in his pocket on which side?" In Phase 3, participants responded to another questionnaire containing five questions designed to test source attributions. For example, one question asked "what color pants was the victim wearing?" Accuracy of source attributions was measured by the number of responses in Phase 3 that contained misleading information from the Phase 2 questionnaire.

Measures

The questionnaires used in this study were designed based on the questionnaires used in the Ridley et al. (2002) study. The misleading and non-misleading questionnaires had 11 questions that were identical on each form. The misleading questionnaire had five questions containing misleading information, and the non-misleading questionnaire had five corresponding questions without misleading information. For example, one misleading question read, "The victim's wallet was in the back pocket of his tan khaki pants on which side?" The victim was wearing blue jeans. The non-misleading version of the question read, "The victim's wallet was in his pocket on which side?" In Phase 3, participants responded to another questionnaire containing five questions designed to test source attributions. For example, one question asked, "What color pants was the victim wearing?" The participant was considered misled if he or she gave the misleading information from Phase 2 (tan in the example) as the answer to the corresponding

question in Phase 3 (“What color pants was the victim wearing?”). Questions were designed to draw from various aspects of the scene including actions, visual details, and dialogue

Data Analysis

The following statement, taken from a study comparing mindfulness and concentrative meditation, was used as a guide for classifying participants’ practice as mindfulness: “I expand my attention/awareness to as many events as possible. I consider nothing to be a distraction. Any new event, physical or mental, I consider part of my meditation” (Valentine & Sweet, 1999, p. 63). All meditators who volunteered for the study were included in the study based on their written descriptions of their meditation practice. The investigator judged that their descriptions of at least part of their meditation practice fit the definition of mindfulness practice described above.

Univariate Analysis of Variance (ANOVA) was used to test whether the meditators and non-meditators differed in their overall accuracy and their source monitoring ability, as measured by their number of misled responses. The test was also used to analyze whether people in the misled condition performed differently from those in the non-misled condition, and whether there was an interaction between meditation condition and misled condition.

RESULTS

It was hypothesized that meditators would show more accurate recall than non-meditators. It was also hypothesized that meditators would show fewer misled responses, suggesting greater source attribution abilities than non-meditators.

Looking first at whether meditators made more accurate source attributions than non-meditators, Univariate Analysis of Variance (ANOVA) was performed to test for differences between meditators and non-meditators in their number of misled responses. The hypothesis was supported. Results indicated that meditators differed significantly from non-meditators in their number of misled responses, $F(1, 25) = 5.399, p = .025$. Meditators in the misled condition ($n = 24$) gave fewer misled responses ($M = 1.00$) than non-meditators ($n = 25$) in the misled condition ($M = 2.55$).

Table 1.

Number of Misled Responses (Total Possible Score=5)

	<u>Mean</u>	<u>Standard Deviation</u>	<u>Sample Size</u>
Meditators Misled	1.00	.667	11
Meditators Not Misled	.65	.904	13
Non-Meditators Misled	2.55	1.924	11
Non-Meditators Not Misled	.79	.860	14

Because it was possible for individuals in the non-misled condition to give misled responses to questions, the mean number of misled responses given by the misled and not-misled groups was compared. The misled group had more misled responses ($n = 22$, $M = 1.85$, $SD = 1.725$) than the non- misled group ($n = 27$, $M = .73$, $SD = .907$) Results of a 2-tailed t -test found the difference significant ($t = -2.989$, $p = .004$).

To test whether meditators showed more accuracy than non-meditators, an ANOVA was performed to test for differences between meditators and non-meditators and between misled and non-misled groups in their total number of correct answers for both questionnaires. The hypothesis was not supported. Results indicated that meditators did not differ significantly from non-meditators $F(1, 48) = 2.091$, $p = .155$. The misled group did not differ significantly from the non-misled group, $F(1, 48) = .023$, $p = .880$. No significant interaction effect was found for the two conditions, $F(1, 49) = 1.501$, $p = .227$. The results show that meditators were no more accurate in their recall than non-meditators, and misleading questions did not affect overall accuracy.

Table 2.

Accuracy (Total Possible Score=21)

	<u>Mean</u>	<u>Standard Deviation</u>	<u>Sample Size</u>
Meditators Misled	7.67	2.100	11
Meditators Not Misled	6.71	3.238	13
Non-Meditators Misled	7.83	2.270	11
Non-Meditators Not Misled	8.87	2.872	14

DISCUSSION

Previous research on mindfulness has shown that, through mindfulness practice, individuals improve their sustained attention (Valentine & Sweet, 1999) and their attentional control (Linden, 1973). These findings are consistent with Kabat-Zinn's definition of mindfulness as "paying attention on purpose, in the present moment" (1994). In the present study I sought to examine more specifically how mindfulness practice affects individuals' attention. In no previous studies of which I am aware have researchers studied whether mindfulness meditation differentially affects individuals' attention to or awareness of external versus internal events. Meditators in this study showed no advantage over non-meditators in the accuracy of their recall but performed better on the source attribution task. This suggests that, through the practice of mindfulness meditation, individuals develop abilities other than accurate recall that are related to making accurate source attributions.

To make accurate source attributions participants needed effective processes for noting a discrepancy between what they experienced and what they read in the post-event questions. In noting such discrepancies, individuals benefit from awareness of their private experience. Researchers believe individuals, through mindfulness practice, increase their awareness of their private experience. On this basis, I propose that meditators outperformed non-meditators on the source attribution task because of their increased awareness of their private experience.

The awareness of private experience developed by mindfulness meditators likely affected both encoding and retrieval. Individuals make more accurate source attributions the more they notice aspects of their experience that are helpful for distinguishing perceived from suggested objects. These aspects include emotional and cognitive responses encoded and associated with the perceptual details (Zaragoza & Lane, 1994). One likely reason why meditators in the present study outperformed non-meditators on the source attribution task is that they noticed more aspects of their experience at encoding. At retrieval, when responding to questions about what they saw and heard, meditators might show more awareness of thoughts and feelings they experience in response to the questions. This awareness might include either noticing the misleading information embedded in some of the questions or noticing a subjective response (e.g., a feeling) to the question, indicating a discrepancy. In some cases individuals might experience a brief recognition that the information differs from their memory. In other cases perhaps the person notices the phrasing of the misleading questions is different from the other questions (because the misleading questions include unnecessary information), and this might cue them to notice the misleading information.

In this study, participants likely made accurate source attributions more because of their experience while answering the questions than while watching the video. This is because participants were asked to recall details of the scene, rather than whether they perceived or imagined certain events. Individuals might rely partly on the vividness of perceptual details in their memories to evaluate whether they perceived or imagined an event. For example, if they clearly remember the color shirt worn by the man who pulled the gun, along with other perceptual details of the scene, they will later feel more certain

the man pulled the gun, and they will show less vulnerability to a suggestion it was a knife. They will judge the memory to be accurate because they vividly remember the perceptual details. Participants in this study were questioned about the perceptual details of the events in the video, not about whether events occurred. Perhaps, more than affecting their experience of watching the video, mindfulness affected individuals' likelihood of noticing the misleading information in the questions and avoiding attributing that information to the video.

The findings of the present study support one of the premises on which the clinical use of mindfulness is based: that individuals increase their ability to observe their thoughts and feelings by practicing mindfulness. For example, in Mindfulness Based Cognitive Therapy for Depression (Segal et al., 2002), the authors describe mindfulness partly as a skill for noticing factors that contribute to mood changes. Individuals use mindfulness to notice, in the present moment, that their emotional response during an event is influenced by factors other than the event, including thoughts about the meaning of the event. With this skill, they increase their ability to respond effectively to the event. Similarly, during a source attribution task, individuals can use mindfulness to notice when their internal responses to questions about an event include experiences unrelated to the focal task of answering the question.

Limitations of This Study

The design of this study did not include controls for several potentially confounding variables. The study did not discriminate between the effects of mindfulness practice and other possible differences between practitioners and non-practitioners. Individuals who choose to practice mindfulness might differ from those who do not in

ways that are relevant to the results of this study. Meditators in this study might have felt more motivated than non-meditators, either because they believe they should perform better than non-meditators or because of an interest in proving the benefits of meditation. Additionally, the non-meditators in this study were all university students, and the meditators were not matched on the basis of their level of education. It seems possible that university students would differ from non-students or individuals with different levels of education in their attention skills.

Also, although all meditators in this study engaged in regular mindfulness meditation, many engaged in a variety of related but different practices. Some lived in a Zen monastery where they regularly engaged in a variety of spiritual practices, including mindfulness, and where their daily lives were highly structured. Others attended a meditation community where they engaged in several types of mindfulness practice, along with a variety of other practices, such as those geared toward developing compassion. Still others practiced at home, alone, and engaged in various types practice. It is impossible to measure the affect of these variables.

It is possible that people forgot or failed to notice the information in the video about which they were later misled. In that case, participants would not have discriminated between two different sources of information. Rather, they would have relied on the only source available to them: the misleading question. More recent studies of source attribution have included questions directly asking participants if they remember the source of the information. The present study would have been more effective had there been a question on the questionnaire designed to elicit from participants whether they remembered the source of the information. When the present

study was designed there was no precedent for including that question. In the study on which the present one was based, the researchers did not ask participants if they remember the source, and studies in which the researchers did ask were published after data was collected in this study.

Additionally, this study included no means for distinguishing specifically where mindfulness had an effect. I do not know whether meditators in the study intentionally used mindfulness skills in performing the task. I also do not know whether the difference between meditators and non-meditators in the study occurred mostly during encoding, mostly during retrieval, or equally at both stages.

The title of this study, “Does Mindfulness Meditation Increase the Accuracy of Source Attributions” appeared on the informed consent form that participants signed before participating. I assumed that participants would have no knowledge of the term “source attributions.” However, it is possible that some participants knew or inferred the meaning of the term. Additionally, participants likely recognized that the study was measuring whether individuals would do better on the task based on their meditation experience. They might have performed differently than they would have without this information.

It is difficult to measure a person’s amount of experience practicing mindfulness. In this study I gathered data about individuals’ years of practice. I did not account for hours of practice, nor does my data include qualitative information about individuals’ practice. Some important aspects of practice are difficult, if not impossible to measure, such as how much of a particular meditation session an individual spends in a state of mindfulness.

In one instance, the misleading and non-misleading questionnaires were testing participants' recall of different information. On the non-misleading questionnaire one question read "what color was the victim's jacket." The paired question on the misleading questionnaire read "the victim wore a blue jacket and a hat. What color was the hat?" This means that about half of the participants were tested on their accurate recall of the color of the jacket, and were compared to the other half, who were asked to recall the color of the hat. This discrepancy could have affected the validity of the accuracy scores in comparing the misled and non-misled groups. However, the main comparisons in this study were done between meditators and non-meditators. About half of each group got the misleading questionnaire. Therefore, the effect of the discrepancy between the two questionnaires did not affect the main findings of the study. Nonetheless, this was a flaw in the design of the study.

Suggestions for Future Research

By seeking other ways to study and measure changes in attention brought about through mindfulness practice, researchers can further clarify the effects of practice. Researchers can plum the depths of the existing lore and literature on mindfulness to generate further research questions. By more clearly defining the nature of the awareness one develops through mindfulness practice, researchers can better understand the benefits of practice. Future researchers could create other tasks to measure differences between mindfulness practitioners and non-practitioners in what they notice about their experience. Additionally, researchers could further investigate the implications of

differences in what practitioners notice, and could specifically relate these implications to clinical benefits.

To investigate the effects of mindfulness practice more accurately, researchers will need to develop more effective ways of measuring mindfulness experience. Perhaps researchers could develop a detailed questionnaire for this purpose, incorporating factors such as years of practice, hours of practice per week, and qualitative aspects of individuals' practice (e.g. different types of practice, experiences during practice, etc...). Such a measure could be used in conjunction with self-report measures of mindfulness, such as the Kentucky Inventory of Mindfulness Skills (KIMS) (Baer, Smith, & Allen, K.B., 2004). Perhaps researchers will discover useful physiological correlates, such as findings from brain-imaging studies, which can be used to validate individuals' qualitative descriptions of their mindfulness practice. For example, researchers might find patterns of brain activity that reliably correspond to meditators' reports of achieving a relatively stable state of mindfulness.

I have outlined suggestions for future research building upon the specific findings of this study. Additionally, there is a need for further research on mindfulness in general. Future research should investigate qualitative changes in cognition at different levels or stages of mindfulness practice. During data collection in this study, a participant who was a resident at a Zen monastery said he had been in the midst of a type of training whereby he was learning to attend exclusively to the present moment and "let it go." He said the training was having a temporary negative effect on his memory because, in letting the moment go, he was retaining little or no trace of it in his memory. During early stages of practice, individuals observe their thoughts; later, reportedly, they have fewer thoughts

and a greater awareness of immediate perception. Source attributions and other aspects of attention and memory might be affected differently as people progress in their practice.

Individuals with no experience practicing mindfulness vary in their degree of mindfulness (Brown & Ryan, 2003). It is possible that some of the non-meditators in the study were relatively very mindful or that some meditators started their practice with a relatively low level of mindfulness and have not yet increased it above the hypothetical population average. Further research is needed to establish the relative benefits of different mindfulness practices and of other factors related to individual variance in mindfulness.

In the present study, as in the Ridley et al. (2002) study, there was no relationship between accuracy scores and misled responses. This result suggests mindfulness practice affected source attributions but not accuracy of memories. The present study mostly tested for memory of perceptual details that might prove relevant in eyewitness testimony, such as the color of clothes worn by perpetrators. Mindfulness might affect accuracy of recall on other memory tasks, such as memory for central versus peripheral information or memory for meaningful versus non-meaningful information.

Memory and attention are closely related: One must notice to remember. Memory for details of an event is affected by the range and choice of objects to which a person attends. Mindfulness has been described as broadened or expanded awareness. It has been differentiated from concentration, where attention is focused and maintained on an object to the exclusion of other objects. Mindfulness means maintaining awareness of the present moment; it has been described as holding one's awareness still as objects pass through it (Linehan, 1993). Still, the breadth of any person's awareness is finite. It might

prove impossible, based on attainable knowledge about mindfulness in general or a particular person's score on a mindfulness scale, to predict specifically what the person is likely to notice or remember. Further research is needed to address questions of how mindfulness practice affects functioning "off the cushion," in life outside of practice. For example, does mindfulness predictably affect how many or what kinds of stimuli a person will notice in various situations? How does this vary based with years of practice or scores on mindfulness scales? How is this affected by the demands of the situation, such as in a "fight or flight" situation, where the adrenal response typically focuses attention, compared with an ordinary, low-stress situation?

Ridley et al. (2002) hypothesized that when more anxious individuals (children, in their research) detect a discrepancy between information stored in memory and new information they perceive the new information as a "threat." As a result, they process the information with more effort. When anxious individuals perceive discrepant information, they might respond by devoting attention and cognitive processes to the discrepancy. Based on the present findings, mindfulness practice appears also to increase one's likelihood of noticing discrepant information. Assuming the mindfulness practitioners were applying their mindfulness skills to the task, they likely benefited from increased alertness and awareness of various aspects of their experience, rather than from focused attention and elaborative processing. By comparing mindfulness to other forms of alertness, researchers could better understand the specific skills comprised in mindfulness.

Mindfulness is probably similar but also significantly different from effortful processing. Researchers have supposed that effortful or elaborative processing offers

benefits in certain situations, such as in making source attributions, over heuristic or automatic processing. If “effortful” implies verbal processing, mindfulness does not qualify. However, if “effortful” means “intentional,” mindfulness might play a role. Mindfulness in its purest form means bare awareness, or attending to experience without adding to it. However, mindfulness in daily life might include noticing a need to think about something or to apply a mental strategy to remember something. Further research might reveal ways in which advanced practitioners of mindfulness approach various cognitive tasks differently from non-practitioners or from less experienced practitioners.

Further research is needed to study cognitive effects of mindfulness practice. Much of the research on cognitive effects of meditation were conducted in the 1970s. Since then many cognitive tests have been developed that could prove useful for studying mindfulness. For example, related to the present study, tests of verbal learning often include an interference trial testing the examinee’s ability to remember a list of words after a second list of words has been presented, and a recognition trial testing the examinee’s ability to identify which words were from which list. Other tests have been designed that could provide information about effects of mindfulness practice, such as tests of continuous or sustained attention.

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Appendix A

Non-Misleading Part I Questionnaire

Was the man crossing the road wearing a bag?

What color was the assailants' car?

Who mentioned car insurance, the victim or one of the assailants?

How many assailants were there?

Was the man who took the wallet the same one who had the gun?

What color was the victim's jacket?

Write any words you saw on store front signs near the crime scene.

Immediately after the collision happened, the assailants got out of their car. What color shirt was the driver of the assailant's car wearing?

Was the man with the gun wearing a chain around his neck?

When the assailants drove away in the car, was the man with the gun in the backseat?

Did the man crossing the street look up when the truck nearly hit him?

Was the man who initially asked about the keys the same one with the gun?

The victim's wallet was in his pocket on which side?

How many assailants drove away in the victim's truck?

What was the color of the car that drove by (shown in slow motion) while the victim was crawling toward his hat?

After the victim refers to his home state as "God's country," what does the driver of the assailants' car say about "God's country?"

Appendix B

Misleading Part I Questionnaire

Was the man crossing the road wearing a bag?

What color was the assailants' car?

Who mentioned car insurance, the victim or one of the assailants?

How many assailants were there?

Was the man who took the wallet the same one who had the gun?

The victim wore a blue jacket and a hat. What color was the hat?

Write any words you saw on store front signs near the crime scene.

Immediately after the collision happened, the assailants got out of their car. What color shirt was the driver of the assailants' car wearing?

Was the man with the red shirt who pulled the gun wearing a chain around his neck?

When the assailants drove away in the car, was the man with the gun in the backseat?

Did the man with the red cap who was crossing the street look up when the truck nearly hit him?

Was the man who initially asked about the keys the same one who had the gun?

The victim's wallet was in a back pocket of his khaki pants on which side?

How many assailants drove away in the victim's truck?

What was the color of the car that drove by (shown in slow motion) while the victim was crawling toward his hat?

After the victim refers to his home state of Alabama as "God's country," what does the driver of the assailants' car say about "God's country?"

Appendix C

Part II Questionnaire

A man was crossing the road in front of the pickup truck when the driver stopped short.
What color cap was the man crossing the road wearing?

What color shirt was the man who pulled the gun wearing?

What color pants was the victim wearing?

What color jacket was the victim wearing?

What state did the victim say he was from?